ಕರ್ನಾಟಕ ರಾಜ್ಯಪತ್ರ

ಅಧಿಕೃತವಾಗಿ ಪ್ರಕಟಿಸಲಾದುದು

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ಭಾಗ ೩
ಸರ್ಕಾರದ ಆಯಾ ಇಲಾಖೆಗಳ ಮುಖ್ಯಸ್ಥರ ಮತ್ತು ಸ್ಥಳೀಯ ಪ್ರಾಧಿಕಾರಿಗಳಿಗೆ ಸಂಬಂಧಿಸಿದ ಅಧಿಸೂಚನೆಗಳು

KARNATAKA ELECTRICITY REGULATORY COMMISSION
No. 16 C-1, Miller Tank Bed Area, Vasantha Nagar, Bengaluru- 560 052

NOTIFICATION
No: KERC/F-30/Vol-10/690, Bengaluru, dated 23.09.2024

The Karnataka Electricity Regulatory Commission (Framework for Resource Adequacy) Regulations, 2024

Preamble:

(1) In exercise of the powers conferred by section 176 of the Electricity Act, 2003 (36 of 2003), the Ministry of Power, Govt. of India, had issued Electricity (Amendment) Rules, 2022 on 29th December, 2022 and further, in exercise of the powers conferred under Rule 16(1) of above Rules, it issued the 'Guidelines for Resource Adequacy Planning Framework for India', in consultation with Central Electricity Authority on 28th June 2023. Under Rule 16(2) of above Rules, the State Commission has to frame regulations on resource adequacy, in accordance with the above said guidelines and the model Regulations framed by Forum of Regulators, if any. The Forum of Regulators, has framed model Regulations for Resource Adequacy Framework in June 2023.

(2) In furtherance, for the past few years, India has been the fastest growing large economy in the World; Currently, it is the fifth largest economy in the World; and it is poised to become the third largest economy by 2030. In parallel, Karnataka is a progressive State and is among the top states in several indicators like GDP, per capita income, sustainable development goals, technology and innovation, foreign direct investment, exports, start-ups, IT services, good governance practices. And to continue this growth, there shall be sufficient electricity to power this growth. It is essential that generation capacity is added at a pace matching the growth in demand- and in fact slightly ahead of the demand; so that the shortage of electricity does not slow down growth. Resource Adequacy planning is designed to ensure this.

(3) Therefore, in exercise of the powers conferred under Section 181 of the Electricity Act, 2003 (36 of 2003), read with section 61, 66, and 86 thereof and all other powers enabling it in this behalf, the Karnataka Electricity Regulatory Commission notified the draft Regulations, namely – Karnataka Electricity Regulatory Commission (Framework for Resource Adequacy) Regulations, 2024 in the Karnataka State Gazette on 14th May 2024 inviting comments/views/suggestions/objections from the Stakeholders, which was published in the Prajavani(Kannada), Vijayavani (Kannada), Times of India(English) and Deccan Herald(English) newspapers on 16th May 2024. The Commission also conducted the Public hearing on 21st August 2024 in the matter, duly notifying in the above said newspapers on 20th July 2024. The Commission considering the comments /views /suggestions /objections of the Stakeholders and interested persons, hereby makes the following Regulations:

Chapter 1
Preliminary

1. Short Title, Extent, and Commencement

1.1 These Regulations shall be called the Karnataka Electricity Regulatory Commission (Framework for Resource Adequacy) Regulations, 2024.

1.2 These Regulations shall extend to the whole of Karnataka.

1.3 These Regulations shall come into force from the date of their notification in the Official Gazette.

2. Objective

2.1 The objective of these Regulations is to enable the implementation of Resource Adequacy framework by outlining a mechanism for planning of generation resources for reliably meeting the projected demand in compliance with specified reliability standards for serving the load with an optimum generation mix.

2.2 The Resource Adequacy framework shall cover a mechanism for demand assessment and forecasting, generation resource planning, power procurement planning, and monitoring and compliance.

3. Scope and Applicability

3.1 These Regulations shall apply to the generating companies, distribution licensees, State Load Despatch Centre, State Transmission Utility, Transmission licensees and other grid connected entities and stakeholders within the State of Karnataka.

4. Definitions

4.1 In these Regulations, unless the context otherwise requires,

a) "**Act**" means the Electricity Act, 2003 (36 of 2003) and subsequent amendments thereof.

b) "**Authority**" means the Central Electricity Authority referred to in sub-section (1) of Section 70 of the Act.

c) "**Capacity Credit**" or "**CC**" means a firm capacity as a percentage of generation resource's installed nameplate capacity that can be counted towards resource

adequacy requirements, which is arrived at in accordance with the applicable methodologies specified in Clause-10 of these Regulations.

d) "**CEA RA Guidelines**" means Guidelines for Resource Adequacy planning framework for India notified by the Authority in pursuance of Rule 16 of the Electricity (Amendment) Rules, 2022 and its subsequent revisions/replacements from time to time.

e) "**Commission**" or "**State Commission**" means the Karnataka Electricity Regulatory Commission (KERC) constituted under sub-section (1) of section 82 of the Act.

f) "**Expected Energy Not Served**" or "**EENS**" means the expected amount of load (MWh) that may not be served for each year within the planning period under study for Resource Adequacy planning.

g) **"Licensee"** means a person who has been granted a licence under Section 14 of the Act and also include a deemed licensee.

h) "**Long-Term**" for the Resource Adequacy planning means time horizon of ten (10) years for development of demand forecast, generation resource plan and procurement plan.

i) "**Long-Term Distribution Resource Adequacy Plan**" or "**LT-DRAP**" means plan for assessment of long-term resource adequacy by the distribution licensee in accordance with the methodology specified in these Regulations.

j) "**Long-Term National Resource Adequacy Plan**" or "**LT-NRAP**" means plan for national level assessment of long-term resource adequacy published by the Authority in accordance with CEA RA Guidelines.

k) "**Long-Term Power Procurement**" or "**Long-Term Contracts**" means procurement of power under any arrangement or agreement with a term or duration of 7 years and above up to 25 years with provision of extension of 5 years at the option of parties of the above arrangement or agreement or such other duration specified in the guidelines for long term Procurement of Electricity, issued by the Ministry of Power, Govt. of India from time to time and approved by the Commission.

l) "**Loss of Load Probability**" or "**LOLP**" means a measure of the probability that a system's load may exceed the generation and firm power contracts available to meet that load in a year.

m) "**Marginal Cost of Reducing Load Shed**" is the effective increase in cost for every unit of load shed reduced. It is calculated as the increase in system costs by the reduction in load shed:

$$\text{Marginal Cost} = \frac{\text{System Cost}_{PRM(i+1)} - \text{System Cost}_{PRM(i)}}{ENS_{PRM(i)} - ENS_{PRM(i+1)}}$$

Wherein, $PRM_{(i+1)}$ is the incremental value of PRM(i).

n) "**Medium-Term Power Procurement**" or "**Medium-Term Contracts"** means procurement of power under any arrangement or agreement with a term or duration of 1 year and above and up to 5 years or such other duration specified in the guidelines for medium term Procurement of Electricity, issued by the Ministry of Power, Govt. of India from time to time and approved by the Commission.

o) **"National Level Planning Reserve Margin"** or **"National Level PRM"** as published by Authority under Long-term National Resource Adequacy Plan (LT-NRAP) in accordance with CEA RA guidelines, as a guidance for the distribution licensees/SLDC/Utilities to consider while undertaking their Resource Adequacy exercises.

p) "**Net Load**" means the load derived upon exclusion of actual renewable energy generation from gross load prevalent on the Grid during any time-block.

q) "**Normalized Energy Not Served**" or "**NENS**" is the total expected load shed due to supply shortages (MWh) as a percent (%) of the total system energy and is normalization of the EENS by dividing it by the total system load.

r) **"Optimal Planning Reserve Margin"** or **"Optimal PRM"** means the planning reserve margin at which the marginal cost of reducing load shed is equal to the value of lost load, defined by the distribution licensee.

s) "**Power Exchange**" means an electronic platform registered as a Power Exchange in terms of the regulations issued by the Central Electricity Regulatory Commission and its amendments/replacements, from time to time.

t) "**Power Purchase Agreement (PPA)**" means the agreement entered into between the Procurer(s) and the Seller pursuant to which the Seller shall supply power to the Procurer(s) as per the terms and conditions specified therein.

u) "**Planning Reserve Margin**" or "**PRM**" is expressed as a certain percentage of peak load forecast of the system, required for conforming to the reliable supply targets specified by the Authority/Commission from time to time.

v) "**Power Sale Agreement (PSA)**" shall mean the back-to-back agreement entered into between the Buying Entity(s) and the Intermediary Procurer/trader for onward sale of power purchased under any power purchase agreement.

w) "**Resource Adequacy**" or "**RA**" means tying up sufficient capacity to reliably serve expected demand of the consumers in the distribution licensee area across all timeframes in compliance with specified reliability standards by the Authority/Commission in a cost effective and secure manner, in line with these Regulations.

x) "**State Level Planning Reserve Margin**" or "**State Level PRM**" means planning reserve margin determined by the distribution licensees in isolation with National Level PRM with reference to its own peak and electrical energy requirement under LTDRAP for its generation resource planning for adequately addressing the demand and supply variations/to meet the prescribed standard of LOLP/NENS conditions as stipulated by the Authority/Commission from time to time, if the same are not met with RAR using National Level PRM and approved/or specified by the Commission.

y) **"State Load Despatch Centre (SLDC)"** means the Centre established under subsection (1) of Section 31 of the Act.

z) **"Southern Regional Load Dispatch Centre(SRLDC)"** means Centre established under subsection (1) of section 27 of the Act.

aa) "**Short Term**" for the Resource Adequacy planning means time horizon of one (01) year for development of demand forecast, generation resource plan, and procurement plan.

bb) "**Short-Term Distribution Resource Adequacy Plan**" or "**ST-DRAP**" means plan for assessment of short-term resource adequacy by the SLDC in accordance with the methodology specified in these Regulations.

cc) "**Short-Term National Resource Adequacy Plan**" or "**ST-NRAP**" means plan for national level assessment of short-term resource adequacy published by Grid India/National Load Despatch Centre in accordance with CEA RA Guidelines.

dd) **"Short-Term Power Procurement"** or **"Short-Term Contracts"** means procurement of power under any arrangement or agreement with a term or duration of 1 day and

above and up to 1 year or such other duration specified in the guidelines for short term Procurement of Electricity, issued by the Ministry of Power, Govt. of India from time to time and approved by the Commission.

ee) **"State Transmission Utility (STU)"** means the Government Company specified as such by the State Government under sub-section (1) of Section 39 of the Act.

4.2 All other words and expressions used in these Regulations, although not specifically defined herein above, but defined in the Act, shall have the meaning assigned to them in the Act. The other words and expressions used herein but not specifically defined in these Regulations or in the Act but defined under any law passed by the Parliament applicable to the electricity industry in the State shall have the meaning assigned to them in such law.

4.3 The specific procedures/provisions of these Regulations, shall override any such similar procedures/provisions specified in the other Regulations issued by the Commission.

Chapter 2
General

5. Resource Adequacy Framework

5.1. Resource Adequacy framework entails the planning of generation resources for reliably meeting the projected demand in compliance with specified reliability standards for serving the load with an optimum generation mix at least cost and in secure manner.

5.2. Resource Adequacy framework shall cover the following important steps:

a) Demand assessment and forecasting
b) Generation resource planning
c) Power procurement planning
d) Monitoring and compliance

5.3. The time periods under long and short term for the purpose of Resource Adequacy planning under these Regulations shall be as defined under Clause 4.1 of these Regulations.

5.4. The distribution licensee and SLDC respectively shall develop and prepare Long-Term Distribution Resource Adequacy Plan (LT-DRAP) and Short-Term Distribution Resource Adequacy Plan (ST-DRAP) in accordance with the conditions outlined under these Regulations.

5.5. The capacity which the distribution licensees tie up shall be a judicious mix of long/medium and short term contracts to ensure security of supply to their consumers at least cost. Over reliance on the electricity market is to be avoided.

Chapter 3
Demand Assessment and Forecasting

6. Short-term and Long-term Demand Forecast

6.1 Demand assessment and forecasting is an important step for Resource Adequacy assessment. It shall entail at least hourly, or sub-hourly or time interval as may be notified by

the Commission from time to time, assessment and forecasts of demand within the distribution area of distribution licensee for multiple planning horizons (short/long-term) using comprehensive, realistic and authenticated data, policies, drivers and scientific mathematical modelling tools.

6.2 The distribution licensee shall be responsible for the assessment and forecasting of demand (MW) and energy (MWh) within its own control area and maintaining historical database.

6.3 The distribution licensee shall determine the load forecast for each consumer category for which the Commission has determined separate retail tariff.

6.4 The distribution licensee shall determine the load forecast for a customer category by adopting any of the following and/or combination of following methodologies, subject to methodologies as specified in the guidelines issued by the Authority from time to time:

a) compounded annual growth rate (CAGR);
b) end use or partial end use;
c) trend analysis;
d) Auto-regressive integrated moving average (ARIMA);
e) AI including machine learning, ANN techniques; and
f) Trend method/Time Series/Econometric methods or any state-of-the art methods (specifying the parameters used, algorithm, and source of data).

6.5 The distribution licensee may use Electric Power Survey (EPS) projections as base and/or any other methodologies other than the above-mentioned after recording the merits of the method. Further, distribution licensee should use best fit of various methodologies for the purpose of demand/load forecast taking into consideration probabilistic modelling approach for various scenarios (viz. most probable, business as usual, aggressive) as outlined under clause 6.14.

6.6 For the purposes of deciding the load forecast for a customer category and the methodology to be used for load forecasting of a customer category, the distribution licensee must conduct statistical analysis and shall select the method for which standard deviation is lowest and R-square is highest[1].

6.7 The distribution licensee shall utilize state-of-the-art tools, scientific and mathematical methodologies, and comprehensive database such as but not limited to weather data, historical data, demographic and econometric data, consumption profiles, impact of policies, drivers etc., as may be applicable to their control area.

6.8 The distribution licensee shall modify the load obtained on either side, for each customer category, by considering the portion of permanent impact[2] for each of the but not limited

[1] If R-squared value is too high, cross check once the sample data, and the details about the process used to fit the model. Compare the same with comparable studies to see what values they obtained. Accordingly, if necessary, adjust R-squared value and use it.

[2] Consider portion which results in permanent impact on the demand in Demand Response and remaining portion in the Supply/Generation Side.

to the following activities. The permanent impact[2] shall be considered by developing trajectories for each of the activities based on the economic parameters, policies, historical data, and projections for the future.

a) demand-side management;
b) open access;
c) distributed energy resources;
d) demand response measures;
e) electric vehicles;
f) tariff signals;
g) changes in specific energy consumption;
h) increase in commercial activities with electrification;
i) increase in number of agricultural pump sets and its solarization;
j) changes in consumption pattern from seasonal consumers;
k) availability of supply;
l) Banking;
m) Net metering; and
n) policy influences such as 24X7 supply to all customers, LED penetration, efficient use of fans/appliances, increased use of appliances for cooking/heating applications, electrification policies, storage, and policies, which can impact econometric parameters, impact of national hydrogen mission. For each policy, a separate trajectory should be developed for each customer category.

6.9 The distribution licensee shall take into consideration any other factor not mentioned in clause 6.8 after recording the merits of its consideration. Further, while undertaking demand forecasts, the distribution licensee shall take into consideration the impact and benefits arising out of the demand side management programmes and plans, energy efficiency measures, energy conservation interventions in pursuance of KERC (Demand Side Management) Regulations, 2015 and amendments thereof.

6.10 The long-term/short-term load profile of the customer categories for which load research has been conducted may be refined on the basis of load research analysis. For the purpose of ascertaining hourly load profile and for assessment of contribution of various customer categories to peak demand, load research analysis shall be conducted and influence of demand response, load shift measures, time of use shall be factored in by distribution licensee with inputs from SLDC. A detailed explanation for refinement conducted must be provided.

6.11 The summation of energy forecast (MWh) for various consumer categories upon suitably adjusting for captive, prosumer, and open access load forecast, as obtained as per clause 6.4 to clause 6.10, as the case may be, shall be the load forecast for the licensee.

6.12 The distribution licensee shall calculate the load forecasts (in MWh) by adding a loss trajectory approved by the Commission in the latest tariff order. In the absence of the loss trajectory as approved by the Commission for the planning horizon, an appropriate loss trajectory stipulated by State or National policies shall be considered with a detailed explanation.

6.13 The peak demand (in MW) shall be determined by considering the average load factor, load diversity factor, seasonal variation factors for the last three years and the load forecasts (in MWh) obtained in clause 6.12. If any other appropriate load factor is considered for future years, a detailed explanation shall be provided.

6.14 The distribution licensee shall conduct sensitivity and probability analysis to determine the most probable demand forecast. The distribution licensee must also develop long-term and short-term demand forecasts for possible scenarios, while ensuring that at least three different scenarios (most probable, business as usual, and aggressive scenarios) are developed on a rolling basis and submit the best suitable scenario of the above three to SLDC by 30th April of each year for the ensuing year(s).

6.15 If any of the Distribution Licensee(s) do not furnish the necessary data as required under these Regulations in a time bound manner to SLDC, then in place of it, SLDC can use such necessary data available with them on behalf of the Distribution Licensee(s). The SLDC can also furnish such data to NLDC/SRLDC/CEA or any other entity under these Regulations. Further, the Distribution Licensee(s) cannot make SLDC liable for any future consequences due to such action by the SLDC.

7. Aggregation of Demand Forecast at State Level

7.1 SLDC shall aggregate demand forecasts of distribution licensees considering the load diversity, congruency, seasonal variation aspects and shall submit state-level aggregate demand forecasts (MW and MWh) including break-up of State demand forecasts (MW and MWh) at different voltage levels along with corresponding losses accounted to the Authority, NLDC and SRLDC by 31st May of each year for the ensuing year(s).

Chapter 4
Generation Resource Planning

8. Generation resource assessment and planning is the second step after demand assessment and forecasting and entails assessment of the existing and contracted resources considering their capacity credit and identification of incremental capacity requirement to meet forecasted demand including planning reserve margin.

9. Methodology of preparation of Resource Adequacy Plan

9.1. For preparation of Resource Adequacy Plans, data on the following needs to be obtained but not limited to:

a) Planning Reserve Margin as prescribed by CEA (National Level PRM) or such higher planning reserve margin determined by the distribution licensee, subject to

maximum limit of optimal PRM[3] and approved/ or specified by the Commission (State Level PRM).

b) Actual demand met by the State / distribution licensee in granular time block resolutions (hourly) for last 5 years.

c) Estimated load growth during the planning period.

d) Technical parameters of conventional generation plants viz. Name of plant, location (State/Region), Capacity (MW) (for existing and planned capacities), Auxiliary Consumption (MW), Maximum and Minimum Generation Limits (MW), Ramp Up and Ramp Down Rate (MW/min), Minimum up and down time, Plant Availability Factor (% of time), etc.

e) Under-construction capacity/retirement of generation capacity/contracted capacity/bilateral contracts, including status of Fuel Supply Agreement, Associated Transmission Facilities, wherever applicable and timelines for completion of the project.

f) Potential investment options, technologies, gestation periods and lifetime of different assets.

g) Capacities and generation profile of renewable generation.

h) Capital costs, variable costs, O&M costs, reserve offers, start up and shut down Cost of generators, etc.

i) Historical forced outage rates and planned maintenance rates of generation capacities.

j) Tie line details and transmission and distribution expansion plans.

k) Spinning reserve requirements.

l) Renewable Purchase Obligation (RPO), Energy Storage Obligation targets, etc.

9.2. The projected hourly or sub-hourly or time interval as may be notified by the Commission from time to time demand for the future years shall be used as inputs into the model. It shall be ensured that the generation expansion planning model chosen is capable of simulating on an hourly chronological resolution[4]. This is necessary to capture the behaviour of the system with respect to ramping of conventional generation, profiles of RE generation, behaviour of energy storage, etc.

9.3. After establishment of demand profile for all future years, the model shall undertake an optimization exercise to minimize the total system cost to meet the future demand adhering to all power system parameters. Following constraints shall be considered while modelling:

a) **Planning Reserve Margin / Resource Adequacy Requirement:** The Resource Adequacy Requirement (RAR) constraint shall ensure that the total Resource Adequacy (Generation capacity) of the distribution licensee fulfils the Planning Reserve Margin as determined by the Authority (National level PRM) and approved

[3] The process/illustrative flowchart w.r.t. optimal PRM study is provided in Clause-12 of these Regulations.

[4] It is preferred to simulate all 8760 hours on a chronological resolution in a year. However, if computational challenges are faced, the Distribution Licensees can select the representative periods. The representative periods chosen are reflective of various projected demand and supply profiles for the base year and future years. Initially, hourly simulation is planned based on hourly data availability, however, the time granularity may be increased to sub-hourly or time interval as may be notified by the Commission from time to time, provided there is availability of such demand and RE generation data.

by the Commission. The resource adequacy requirement for each distribution licensee is computed as:

*RAR[5] = contribution[6] to forecasted national peak demand in GW * (1+National level PRM)*

From the supply side, the RAR is the sum of the "firm capacity" or "capacity credits" of contracted / planned capacities (including renewables, storage, other resources such as demand response) along with derated interconnection limits (imports)[7]. Both, supply side and demand side RAR shall match.

The capacity credits for generating resources and demand response resources to meet the national peak are as estimated by CEA[8]. The capacity credits published by CEA for each resource type may differ between existing and new resources and between resources in different regions. For example, a solar based power plant in the southern region will have a capacity credit which could be different compared to a solar plant in the northern region. Similarly, an upcoming wind-based power plant could have a different capacity credit compared to an already commissioned wind plant in the same region. Distribution licensees/Utilities shall use these capacity credits while planning to meet their RAR. For example, a distribution licensee having a PPA with an existing solar based power plant located in a southern state would use the capacity credit of existing solar based power plants in the southern region.

b) **Portfolio balance constraints:** The portfolio balance constraints shall ensure that the total generation within a control area of State/Distribution licensee and the import of power to the control area of State/Distribution licensee is equal to the sum of the demand, the exports from the control area of State/Distribution licensee, any energy not served and curtailment, for each hour.

c) **RE Generation constraints:** For renewable resources, such as solar and wind, the generation is constrained as per the hourly profile of the resource. Historic profiles[9] of renewable sources shall be used to generate the hourly profiles.

d) **Conventional Generation constraints:**

- Unlike solar and wind, thermal resources are dispatchable. However, the thermal resources are bound by constraints such as maximum and minimum generation limits, ramp rates, spinning reserve offers, plant availability and unit commitment decisions.

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[5] The generation resource requirement by a distribution licensee also depends on its LTDRAP and it shall be equal or higher than RAR.

[6] This is calculated as distribution licensee's demand at the time of national peak demand. The SLDC shall allocate each distribution licensee's share in the national peak within 15 days of the publication of LT-NRAP.

[7] The calculation of firm capacity is provided in Clause 10 of these Regulations.

[8] The methodologies that can be used to determine capacity credits for generating resources and demand response resources are outlined in Clause 10 of these Regulations.

[9] Historical profile of RE should be considered for at least 7 years, where there is availability of data to create their hourly profile. This is because, El Niño effect occurs on average every 2-7 years. During this period of 7 years exclude the abnormal values prior to average. These abnormal values can also be a result of act of God, disaster and act of war.

- The dispatch (energy offer) plus the reserve offer (if, specified through regulations) for each generator is constrained to be within the maximum and minimum generation limits. Generation between two consecutive time blocks also must be within the ramping capabilities of the resources. Unit commitment decisions, such as start-up/shut-down, minimum up and down times, etc., require binary variables to implement and are to be included. Additionally, generation units may have periods of outages which may need to be captured by using an availability factor.
- The capacity for each year needs to be tracked by a constraint which shall ensure that the capacity in a particular year is equal to the capacity last year plus any new capacity investment minus capacity retirement, if any.

e) **RPO constraints:** Fulfilment of Renewable purchase obligation should be considered as one of the objectives of Resource Adequacy. Technology options like renewable generation for round the clock energy supply backed with storage (Battery and PSP), standalone renewable capacity along with hydro capacity for balancing renewable generation may be considered while carrying out resource adequacy exercise for distribution licensees.

f) **Storage constraints:** Due to the intermittent nature of renewable generation, the need for resources which can store surplus energy and despatch the stored energy during low RE periods becomes vital. Storage charge and discharge at any instant are constrained by the storage level or the state of charge (SoC) of the storage resource, and the maximum charge / discharge limit. The resource can only discharge if there is sufficient energy present due to prior charging of the resource. To implement this, considering the chronological sequence of time is also important. Since storage resources convert electricity to other forms of energy, there are also some efficiency losses (round-trip efficiency) which shall be accounted for. Different technologies may have different discharge periods (energy limits), power outputs (maximum charge / discharge) and levels of efficiency.

Further, keeping Resource Adequacy in view, Storage charge and discharge at any instant cannot be simultaneous[10].

g) **Operating (Spinning) Reserve constraints:** Operating reserve constraints ensure that sufficient resources are in the system and kept online or on standby each hour to account for load forecast errors, intermittency of renewables or meeting contingencies in the real time. The thumb rule for operating reserve requirement shall be defined based on discussions with the state SLDC and shall be considered as an input parameter to the model or as specified in the national electricity policy, whichever is minimum.

[10] For which, mathematical form of this constraint viz. NC(t) + ND(t) ≤ 1 shall be considered. Wherein, NC(t) represents a Boolean variable whose value is 1 when it is not charging at period t and ND(t) represents a Boolean variable whose value is 1 when it is not discharging at period t.

The SLDC from time to time shall specify the operating reserve requirement. In case of non-compliance of Operating (Spinning) Reserve constraints as above, non-compliance charges equivalent to Marginal Capacity Charge (Rs/kW/month) or 1.25 times the Average Capacity Charge(Rs/kW/month) whichever is higher for the power procurement by concerned distribution licensee under its APR/Tariff Order for the relevant financial year is applicable for the shortfall for operating reserve requirement, shall be disallowed by the Commission in its APR and same shall not be claimed for recovery by distribution licensees in future in any manner including through its future ARR/APRs.

h) **Demand Response:** Potential for demand side management such as shifting of load or demand response can be considered while undertaking the Resource Adequacy Plan(RAP). The constraints such as periods when load shifting can occur, and the maximum quantum of load which can be shifted over a period shall be included.

i) **Transmission/Distribution Sub-Stations/line Constraints:** Transmission and Distribution Sub-Stations/line Constraints including cost and losses associated with it for transfer of power shall be included.

If there are transmission/distribution sub-stations/line constraints, which are causing obstacles to cost effective and secure resource adequacy plan in terms of these Regulations, the same shall be brought immediately to the notice of the Commission and to the concerned utilities for taking appropriate measures for its removal.

10. Capacity Crediting of Generation Resources and Calculation of Firm Capacity

10.1. This step is important for determining how much of energy-limited resources (hydro, wind, solar, storage) may count toward resource adequacy requirements. Generation planning is set to become more complex as larger amounts of weather-based, variable renewable generation are added to the system. This is because resources such as wind and solar PV are intermittent, and their generation may not coincide with periods of peak demand.

10.2. Each generator can provide a "firm capacity," which represents the amount of power the generator can reliably provide. Capacity credit expresses firm capacity as a percentage of the installed nameplate capacity.

10.3. Following are the various methodologies to determine capacity credits of Renewable energy adopted internationally. These methodologies can also be extended to demand response resources.

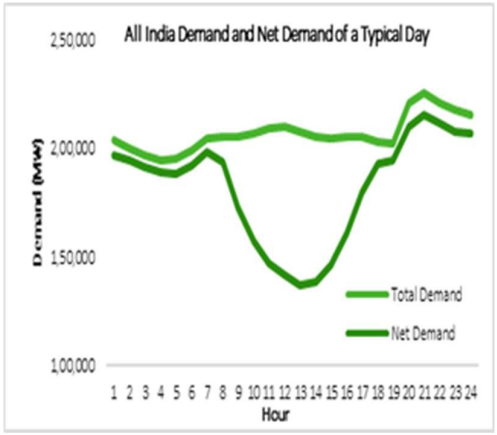
a) **Capacity credit approximation with Top Demand Hours:** In this case, a basic approximation of capacity credit can be obtained by averaging the historical contribution of a generator / generator class during peak demand hours. The selection of how many peak demand hours to include, however, often varies across geographies.

b) **Capacity credit approximation with Top Net Load Hours:** In this case, consideration is given to the fact that periods of system stress occur when high demand coincides with low renewable energy generation. A metric called 'net load' is defined as 'total renewable energy generation subtracted from overall demand', which must be met from dispatchable resources like thermal plants, hydro plants, etc. Due to system stress caused by the duck curve, net load is a better proxy for system stress for new capacities than peak demand. In this method, capacity credit can be obtained by averaging the contribution of a generator / generator class during top net load hours.

The Top Net Load based approach/methodology for determination of Capacity Credit factors for Renewable generation resources (including wind and solar) shall be adopted as under:

(i) For each year, the hourly recorded Gross Load for 8760 hours (or time-block) shall be arranged in descending order.

(ii) For each hour, the Net Load is calculated by subtracting the actual wind or solar or any other Renewable generation corresponding to that load for 8760 hours (or time-block) and then arranged in descending order similar to Step 1.



(iii) The difference between these two load duration curves represents the contribution of capacity factor of wind generation or solar or any other Renewable generation, as the case may be.

(iv) Installed capacity of wind or solar or any other Renewable generation capacity is summed up corresponding to the top 250 load hours.

(v) Total generation from wind or solar generation or any other Renewable generation corresponding to these top 250 hours is summed up.

(vi) Resultant Capacity Credit (CC) factor is calculated as per formula below:

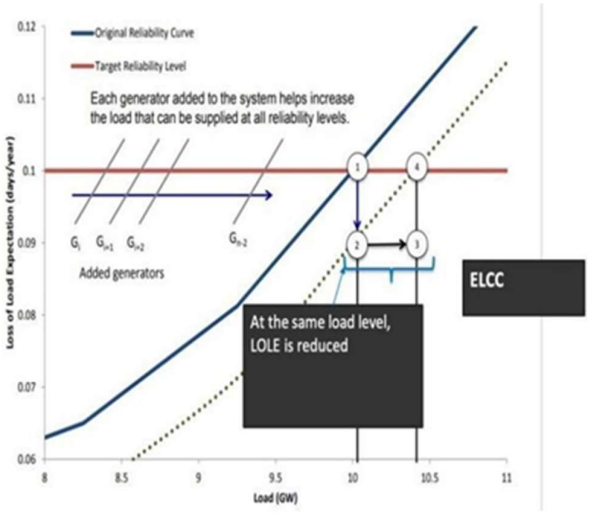
$$\text{CC factor} = \frac{\text{Sum of Wind or Solar or any other Renewable generation for top 250(i.e. x) hours}}{\text{Sum of Wind or Solar or any other Renewable Capacity for top 250(i.e. x) hours}}$$

(vii) The process for Capacity Credit factor determination shall be undertaken for each year for duration of past several years[11] and the resultant Capacity Credit is the average of Capacity Credit values of past several years[12].

[11] Historical profile of RE should be considered for at least 7 years, where there is availability of data to create their hourly profile. This is because, El Niño effect occurs on average every 2-7 years. During this period of 7 years exclude the abnormal values prior to average. These abnormal values can also be a result of act of God, disaster and act of war.

[12] Historical profile of RE should be considered for at least 7 years, where there is availability of data to create their hourly profile. This is because, El Niño effect occurs on average every 2-7 years. During this period of 7 years exclude the abnormal values prior to average. These abnormal values can also be a result of act of God, disaster and act of war.

c) Expected Load carrying capability: In this method, a model uses an hourly time-series demand data for a particular period. The model also uses the availability of different generation resources in each hour of the year. Random outages of generators are also applied considering the historical and expected outage conditions. Determine supply matching is used to determine the LOLP of the system.



- To calculate capacity credit, the model first removes a generator from the system and calculates the system LOLP. This represents Point 1 in the system reliability curve, as shown alongside.
- The model then adds the generator back to the system and repeats the LOLP calculation. The additional generator increases system-wide firm capacity and resource adequacy, so that the curve shifts right to Point 2 (system reliability is higher), and so it can accommodate more load at the previous LOLP (Point 4). The additional load that can be accommodated represents the generator's ELCC.

10.4. Considering the Variability and Uncertain nature of Renewable Energy Resources, the Capacity Factor Approximation with Top Net Load Hours can be considered to determine the capacity credits for Renewable Energy Resources. The ELCC method can be adopted later, once the required capabilities and data are available with the state utilities. Always, among these two methods, the one which results closer to the actual values i.e. tighter of the two methods shall be applied. If there is any deviation from these approaches, the Distribution Licensees/Utilities have to furnish detailed explanation with reasons behind it.

10.5. Capacity Credit factors for hydro generation resources shall be computed based on water availability with different Capacity Credit factors for run-of-the-river hydro power projects and dam-based/storage-based hydro power projects. The Thermal capacity credit is computed by reducing the auxiliary consumption and the forced outage rate from the installed capacity alongside considering Fuel availability. Planned outage rate is generally not considered, as planned maintenance may be carried out during low net-demand periods and thus may not affect reliability.

10.6. The utilities may plan their firm capacity as per their contribution in the national peak which implies that the capacity credits of all resource types are to be calculated on the national-level load profile. However, the distribution licensee shall contract additional resources source-wise if required considering capacity credits of resource types connected to their own control area and its own load profile.

10.7. The calculation of firm capacity to meet the Resource Adequacy Requirement (RAR) is shown below:

$$
\begin{aligned}
RAR = & \sum_{i=1}^{num\_solar} Solar\_Capacity * Solar\_Capacity\_Credit \\
& + \sum_{i=1}^{num\_wind} Wind\_Capacity * Wind\_Capacity\_Credit \\
& + \sum_{i=1}^{num\_hydro} Hydro\_Capacity * Hydro\_Capacity\_Credit \\
& + \sum_{i=1}^{num\_thermal} Thermal\_Capacity * Thermal\_Capacity\_Credit \\
& + \sum_{i=1}^{num\_nuclear} Nuclear\_Capacity * Nuclear\_Capacity\_Credit \\
& + \sum_{i=1}^{num\_storage} Storage\_Capacity * Storage\_Capacity\_Credit \\
& + \sum_{i=1}^{num\_other} Other\ Resource\_Capacity * Other\ Resource\_Capacity\_Credit \\
& + \sum_{i=1}^{num\_other} Import\_limit * capacity\_credit
\end{aligned}
$$

11. Ascertaining Resource Adequacy Requirement and its Allocation for Control Area

11.1. The SLDC, on behalf of the distribution licensees in the State shall provide to Authority, NLDC and SRLDC by 31st May of every year, the details regarding demand forecasts (peak and energy requirement) for the next 10 years, assessment of existing generation resources and such other details as may be required for the LT-NRAP and ST-NRAP as specified in CEA RA Guidelines.

11.2. The reports of LT-NRAP and ST-NRAP as published respectively by Authority and NLDC by 31st July of every year, in line with CEA RA Guidelines, for the period starting from the month of April in the subsequent year, specifies the following:

The report of LT-NRAP, published by Authority:

a) The National level PRM as a guidance for the States/UTs to consider while undertaking their RA exercises.
b) The Optimal Generation mix for the next 10 years required to ensure that the national-level system is RA compliant while meeting the All-India demand at least-cost. This shall guide capacity buildout investments in the country.
c) The capacity credits for different resource types on a regional basis.
d) Each State/UT's contribution towards national peak (peak contribution).

The report of ST-NRAP published by NLDC:

The parameters such as demand forecasts, resource availability based on under-construction status of new projects, planned maintenance schedules of existing stations, station-wise historic forced outage rates and decommissioning plans.

11.3. The SLDC shall allocate each distribution licensee's share in the national peak within 15 days of the publication of LT-NRAP.

11.4. Based on the share in national peak provided in LT-NRAP, each distribution licensee shall plan to contract the capacities (peak contribution * (1+National level PRM)) to meet their Resource Adequacy Requirement (RAR) at the time of national peak. The distribution licensees shall demonstrate to the Commission 100% tie-up for the first year and a minimum 90% tie-up for the second year to meet the requirement of their contribution towards meeting national peak. Only resources with long / medium / short-term contracts shall be considered to contribute to the RAR.

The share of long-term contracts is to be in the range of 75-80%[13] of the total supply side RAR, or as specified by the Commission. The medium–term contracts are to be in the range of 10% - 20% of the total supply side RAR while the rest can be met through short-term contracts. Power procurement through the power exchanges, such as the Day-Ahead Market segment, shall not be considered to contribute to RAR. However, these ratios of long, medium and short term contracts may be reviewed periodically by the Commission based on further experience.

For subsequent three years, the distribution licensees shall furnish a plan to meet estimated requirement of their contribution to meet national peak for the Commission's approval.

11.5. Each Distribution licensee shall undertake a Resource Adequacy Plan (RAP) for a 10-year horizon (Long-term Distribution Licensee Resource Adequacy Plan (LT-DRAP)) to meet their own peak and electrical energy requirement. The plan shall be vetted/validated by the Authority for leveraging the benefit of national level optimization for the Distribution licensees. The LT-DRAP shall be undertaken as per the methodology outlined in these Regulations. Further,

a) The Distribution licensees shall take inputs if required from the LT-NRAP like PRM, capacity credits, etc., while formulating their LT-DRAP and submit their Resource Adequacy plans to CEA by 30th September of each year for the period starting from the month of April in the subsequent year.

b) After being vetted by CEA, the LT-DRAP along with details for meeting the RAR of national peak for the Distribution licensee(s)/Utility and its own peak and electrical energy requirement shall be submitted to the Commission by the Distribution licensee(s) by 30th November of each year for the period starting from the month of April in the subsequent year, for its approval.

c) The Commission shall approve the Distribution licensee(s) contracting plan for coincident peak contribution and to meet their own energy and peak considering the fulfillment of conditions by the Distribution licensee(s) under these Regulations and subject to other terms and conditions of these Regulations by 31st December of each year for the period starting from the month of April in the subsequent year.

d) Distribution licensees are free to consider higher planning reserve margins as defined under 'State Level PRM' in Clause 4.1 of these Regulations, subject to approval from the Commission.

[13] This value is subject to change from time to time, as guided by CEA

e) The LT-DRAP shall be carried out by the distribution licensees on an annual rolling basis considering the contracted capacity as a part of the system and shall optimize for additional capacity required.

11.6. Distribution licensees, through the LT-DRAP, shall also demonstrate to the Commission, 100% tie-up for the first year and a minimum 90% tie-up for the second year to meet the requirement of their peak demand and energy requirement, subject to adequately addressing the demand and supply variations/to meet the prescribed standard of LOLP/NENS conditions as stipulated by the Authority/Commission from time to time, with a mix of long-term, medium-term and short-term contracts, including power exchanges.

Provided that, the Distribution licensees shall demonstrate to the Commission, 100% tie-up to meet the requirement of peak demand and energy requirement for the entire control period for which application for determination of retail supply tariff shall be made before the Commission under KERC (Multi Year Transmission, Distribution and Retail Supply Tariff) Regulations, 2024 and its amendments from time to time, subject to other constraints in meeting the peak demand and energy requirement.

The composition of the contracts shall depend upon the load curve of each distribution licensee. The share of long-term contracts is to be at least 75%[14] of the required capacities as per LT-DRAP or as specified by the Commission. The medium–term contracts shall be in range of 10-20% while the rest can be met through short-term contracts. For subsequent years of the planning horizon, distribution licensees shall demonstrate their plans to contract existing capacities and plans to build or contract future capacity.

Keeping reliability and cost economics, the Commission from time to time by an order can prescribe 'State Level PRM' by itself and same needs to be considered by the SLDC/distribution licensees w.r.t their peak demand and energy requirement.

11.7. The share of long-term contracts in the entire mix of the contracts of the distribution licensees/utility shall be atleast the maximum of the quantum of long term contracts determined for meeting RAR of national peak and quantum obtained from LT-DRAP for fulfilling own energy and peak requirement.

11.8. The Distribution Licensee shall submit the details of the contracted capacities for the ensuing year for meeting RAR of national peak to the SLDC after approval of the Commission by 31st January of each year. The SLDC shall aggregate the total contracted capacities at the state level and submit the information to the SRLDC by 15th February of each year. The SRLDC will be aggregating the capacities at the regional level and will be submitting the information to the NLDC by 28th of February of each year. NLDC will be aggregating the capacities at the national level and check compliance with ST-NRAP and identify shortfall for the ensuing year, if any. In case of shortfall, NLDC will either communicate the shortfall to the Commission for compliance by distribution licensees or facilitate a national-level auction for the balance capacity[15] with participation from

[14] This value is subject to change from time to time, as guided by CEA
[15] Balance capacity= (1+National PRM) X National Peak-sum of contracted capacities

distribution licensees with capacity shortfall[16]. The contracting for the balance capacity shortfall shall be completed by the month of March prior to the start of the delivery year (1st April). The procedure notified by NLDC shall be adopted by the distribution licensees to participate in the national level auction for the procurement of the balance capacity.

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11.9. In similar lines with ST-NRAP, the SLDC shall prepare one-year look ahead ST-DRAP, on an annual basis for operational planning, at the state level based on the LT-DRAP study results. The SLDC shall aggregate the capacities at the State level and check compliance with ST-DRAP and identify shortfall for the ensuing year, if any. In case of shortfall, SLDC will communicate the shortfall to the distribution licensees for compliance. Further, the SLDC shall review the ST-DRAP on a daily, weekly, monthly and quarterly basis based on actual availability of generation resources and coordinate with the distribution licensees for compliance.

11.10. The abstract of Resource Adequacy implementation timelines is specified in Clause 22 of these Regulations.

12. Determination of LOLP / NENS, Optimal Planning Reserve Margin and Resource adequacy targets:

12.1. The optimal level of "target" or "planning" reserve margins should be arrived at through measures such as "Loss of Load Probability (LoLP)" and Normalized Energy Not Served (NENS). Loss of load can happen due to various factors such as:

- Forced outages/planned maintenance of conventional generation
- Real time unforeseen excursion in demand/demand forecast errors
- Generation forecast errors /RE intermittency

12.2. A loss of load occurs when the system load exceeds available capacity in a particular time. Appropriate LOLP / NENS metrics should be considered based on consultation with stakeholders and international best practices.

12.3. The first step in determining the Resource Adequacy targets would be to determine the target generation capacities at a nominal Planning Reserve Margin using a generation planning model.

12.4. Once the generation capacities are estimated, it becomes important to estimate the several demand-supply patterns and then determine if the required generation capacity in the system can always meet demand reliably by calculating the loss of load and energy not served. A natural outcome of the above objective is to construct many possible future scenarios based on the uncertainty surrounding the demand for power, intermittency of RE sources, availability of power plants, tie-lines, inter-state and inter-regional transmission constraints etc. These future scenarios shall be constructed based on following indicative parameters viz:

- Demand variations / forecast errors

[16] Capacity short fall = (1+National PRM) X Licensee Demand during National Peak – sum of contracted capacities by the licensee

- Hydro conditions (normal, wet, or dry years)
- Planned and forced outages of power plants and interconnectors
- RE Generation forecast errors, etc.

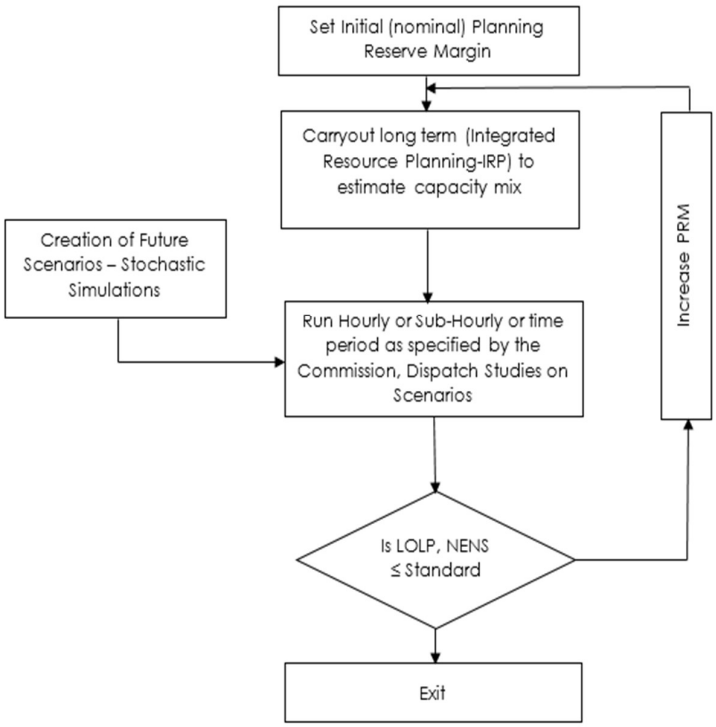
12.5. Multiple future scenarios should be created using stochastic models to account for uncertainty and analyse any occurrence of lost load. Each such future scenario is established based on historical data. The key inputs for generating future possible states are as follows:

- **Demand volatility:** Uncertainty in demand can be built into the model through two categories, long-term uncertainty driven by underlying factors such as load growth forecasting errors, unanticipated economic growth, etc., and short-term uncertainty which may be defined as the sum of a typical (or mean) monthly load pattern for the day and the historical deviation observed from the mean load.
- **Conventional generator outages:** Planned outages and scheduled maintenance for thermal generators may be scheduled either based on historic patterns or during low demand periods based on a uniform probability distribution. For forced outages, Monte Carlo draws for each unit based on historical outage rates may be simulated.
- **Variable Renewable Generation Intermittency:** To capture the intermittency of solar and wind plants, solar PV and wind generation data of past several years[17] can be analysed and multiple scenarios which match the projected CUF levels may be created. Annual CUF projections may also be generated through Monte Carlo Draws based on the annual CUFs observed in the historical profiles.
- **Availability of ATC for short-term import:** In the distribution licensee-level / State-level planning, short-term import is limited to the available transfer capability. However, as there is no visibility about the power generation profile of other States, unpredictability in the availability of tie line power form other utilities and regions must be factored in. To incorporate the above-mentioned unpredictability, availability of each tie line for each hour can be derated by a factor drawn from a probability distribution using Monte Carlo Simulations. Details on the appropriate probability distribution to be considered may be taken as provided by NLDC / CEA from time to time.

[17] Historical profile of RE should be considered for at least 7 years, where there is availability of data to create their hourly profile. This is because, El Niño effect occurs on average every 2-7 years. During this period of 7 years exclude the abnormal values prior to average. These abnormal values can also be a result of act of God, disaster and act of war.

12.6. Once the demand-supply projections/scenarios are established and the possible future states are predicted, a demand-supply matching simulation with the estimated capacities should be performed. The objective of such a simulation would be to use the capacities obtained from the Resource Adequacy Plan to meet the demand and assess the duration of the loss of load events and energy not served for each scenario and for the specified planning margin/capacity mix.

Flow Chart of Optimal Reserve Margin Study



12.7. The above process needs to be then iterated by incrementing the planning reserve margin levels until the desired levels of LOLP / NENS is achieved in the system. This iterative model would enable identification of a target PRM level as per the desired LOLP figures. An illustrative flowchart of the process is shown in above.

12.8. While arriving at the target LOLP / NENS figures, consideration should be given to system costs. The objective should be to have an optimal level of Reserve margins which would represent the optimal trade-off between system costs and reliability. For this purpose, an evaluation of the marginal cost of reducing load shed is required. The PRM at which the marginal cost of reducing load shed is equal to the Value of Lost Load as defined by the distribution licensee is the economically optimal PRM.

Chapter 5
Power Procurement Planning

13. Procurement planning shall consist of (a) determining the optimal power procurement resource mix, (b) deciding on the modalities of procurement type and tenure, and (c) engaging in the capacity trading or sharing to minimize risk of resource shortfall and to maximize rewards of avoiding stranded capacity or contracted generation.

14. Procurement of Resource Mix

14.1 The distribution licensee in its power procurement strategy shall identify an optimal procurement of generation resource mix to enable smooth RE integration in its portfolio of power procurement resource options while meeting reliability standards.

14.2 For identification of the optimal generation procurement resource mix, optimization techniques and least-cost modelling shall be employed in order to avoid stranding of assets. The distribution licensee shall engage in adoption of least cost modelling and optimization techniques and demonstrate the same in its overall power procurement planning exercise to be submitted to the Commission for its approval.

14.3 Procurement by distribution licensees shall be consistent with the identified resource mix and considering overall national electricity plan and policies notified by the Appropriate Government from time to time.

14.4 The outcome of the Resource Adequacy Studies shall provide the quantum and type of generation resources required in the portfolio of a distribution licensee to meet the demand in an optimal (least cost and secure) manner. The future capacity mix may comprise of existing capacities, planned capacities and capacity addition required to meet the increasing demand of the distribution licensee(s)/utility considering appropriate gestation period of the generation resource.

14.5 The distribution licensee shall contract the optimal portfolio of resources to meet its future demand and Resource Adequacy Requirement (RAR) obligations, based on the output derived from the LT-NRAP study results. Long / medium / short-term firm contracts of generation resources shall be considered to contribute to the RAR. Power procurement through the power exchanges, such as the Day-Ahead Market segment, shall not be considered to contribute to RAR.

14.6 The distribution licensee shall contract additional resources source-wise if required based on the LT-DRAP to meet its own peak demand subject to approval by the Commission.

14.7 The distribution licensee can take measures either to put up their own generation capacities for meeting their future demand or shall procure the required resources through the tariff based competitive bidding guidelines for procurement of power notified under the provisions of section 63 of the Electricity Act 2003.

14.8 The power capacity procurement from renewable energy sources for fulfilling the RPO targets shall be carried out taking into account the RE potential in the State and fungibility within the RE resources as per the latest RPO order. The power procurement corresponding to wind, solar PV, Wind solar Hybrid, Round the Clock (RTC) power shall be carried out as per the guidelines for tariff based competitive bidding process for procurement of power from respective grid connected wind, solar PV, Wind solar Hybrid, Round the Clock (RTC) power projects.

14.9 The Distribution Licensee can contract storage capacity corresponding to the results of LT-DRAP capacity addition requirement for future years as per the guidelines issued under the provisions of Section 63 of the Electricity Act, 2003 for procurement of energy from BESS through competitive bidding, from grid connected Projects.

14.10 The Distribution Licensee can contract power through Central Agencies / Intermediaries / Traders / Aggregators / Power Exchanges or through bilateral agreements / Banking arrangement / Capacity sharing with other distribution licensees. The Distribution Licensee can carry out power procurement on short-term and medium term basis through DEEP and PUShP portal.

14.11 The distribution licensee must ensure that procurement process for the projected demand is undertaken and completed sufficiently in advance so that the procured capacity becomes available when it is required to serve the projected load. The following table gives the number of years before which procurement process must be completed in advance as compared to the year of projected requirement for various types of generation and types of procurement:

Resource	Long Term	Medium Term
Coal/Lignite based Capacity	7	2
Hydro	9	2
Solar	2	1
Wind	3	1
PSP	5	3
Other Storage	2	1
Nuclear	9	3

15. Special Provisions

15.1 In case uniform tariff at the State level/among a set of distribution licensees in a State is a necessity and due to which resource adequacy plan at the distribution licensee level couldn't be implemented in terms of these Regulations, then with the approval of the Commission and the Authority, such Distribution licensees in combination through their special purpose vehicle, designated for the purpose can opt for Resource Adequacy plan at the State level/as a combination among them, subject to all other terms and conditions of these Regulations.

15.2 For more authenticity and accuracy, the distribution utilities can opt for more granular time periods than prescribed or specified by the Authority/Commission for formulating LT-DRAP for the entire planning horizon or selected period in line with LT-NRAP.

16. Approval of Power Purchase Agreement

16.1 Any new Capacity arrangement/tie-up shall be subject to the prior approval of the Commission in view of necessity, reasonableness of cost of power purchase and promotion of working in an efficient, economical and equitable manner.

16.2 All procurement of Long / Medium / Short-term power from various sources shall be carried out as per the Guidelines / Rules / Regulations / Policies issued by the Central Government / Appropriate Commission from time to time.

16.3 Any new power purchase agreement / power sale agreement for Long / Medium-term or amendments to existing Long / Medium-term Power Purchase Agreement (PPA's) / Power Sale Agreement (PSA) entered into by the distribution licensee shall be subject to the prior approval of the Commission.

16.4 The distribution licensee shall submit the list of all existing Power Purchase Agreements/tie-ups executed with different conventional power plants as well as RE Generators to the Commission along with the Resource Adequacy plan.

17. Variation in Power Purchase

17.1 The distribution licensee may undertake additional power procurement during the year, over and above the approved resource adequacy procurement plan under the following exemptions:

a) In case, where there has been an unanticipated increase in the demand for electricity or a shortfall or failure in the supply of electricity from any approved source of supply during the year or when the sourcing of power from existing tied-up sources become costlier than other available alternative sources, the distribution licensee may enter into additional agreement for procurement of power.

b) The distribution licensee may enter into a Short-term arrangement or agreement for procurement of power when faced with emergency conditions that threaten the stability of the grid, or when directed to do so by the SLDC/SRLDC/NLDC to prevent grid failure or during exigency conditions and for banking with other States on Short-term basis without prior approval of the Commission. Provided that the details of such Short-term procurement shall be submitted to the Commission within 15 days from the date of procurement of power.

Chapter 6
Monitoring and Compliance

18. Monitoring and Compliance

18.1 **Monitoring and Reporting**: The distribution licensees, SLDC, Utilities shall abide by the timelines, procedure and methodology specified under these Regulations. The SLDC should monitor the entire process and shall submit monthly compliance to the Commission.

18.2 **Treatment for shortfall in RA Compliance**: Distribution licensees shall comply with the RA requirement and in case of non-compliance, non-compliance charges equivalent to Marginal Capacity Charge (Rs/kW/month) or 1.25 times the Average Capacity Charge (Rs/kW/month) whichever is higher for the power procurement by concerned distribution licensee under its APR/Tariff Order for the relevant financial year is applicable for the shortfall in RA compliance, shall be disallowed by the Commission in its APR and same shall not be claimed for recovery by distribution licensees in future in any manner including through its future ARR/APRs.

Chapter 7
Roles and Responsibilities and Timelines

19. Data Requirement and Sharing Protocol

19.1 Distribution licensees shall maintain and share with SLDC all data related to demand assessment and forecasting such as but not limited to consumer data, historical demand data, weather data, demographic and econometric variables, T&D losses, actual electrical energy requirement and availability including curtailment, peak electricity demand, and peak met along with changes in demand profile (e.g.: agricultural shift, time of use, etc.), historical hourly load shape, etc.

19.2 Distribution licensee shall maintain all statistics and database pertaining to policies and drivers, such as LED penetration, efficient fan penetration, appliance penetration, demand side management and energy efficiency measures, increased usage of electrical appliances for cooking, etc., in households, increase in commercial activities for geographic areas/regions, increase in number of agricultural pumps and solarization within control area, changes in specific energy consumption, consumption pattern from seasonal consumers such as tea plants, Demand Side Management and Distributed Electric Resources, Electric Vehicles and Open Access, National Hydrogen Mission, reduction of AT&C losses, etc.

19.3 Distribution licensee shall maintain at least past 10 years of statistics in its database pertaining to consumption profiles for each class of consumers, such as domestic, commercial, public lighting, public water works, irrigation, LT industries, HT industries, railway traction, bulk (non-industrial HT consumers), open access, captive power plants, insights from load survey, contribution of consumer category to peak demand, seasonal variation aspects, etc.

19.4 The distribution licensee shall share information and data pertaining to the existing and contracted capacities with their technical and financial characteristics with SLDC for computation of state-level capacity credit factors and for preparation of state-level assessment.

19.5 SLDC shall maintain the licensee-specific as well as aggregate for the state as a whole, the statistics and database pertaining to aggregate demand assessment and forecasting data mentioned above and share state-level assessment with the Authority and the NLDC for national assessment from time to time.

19.6 SLDC shall aggregate generation data and share state-level assessment with the Authority and NLDC for assessment of RA requirement.

19.7 STU/SLDC shall communicate allocation of national RA requirement to the distribution licensees.

19.8 It is the responsibility of Distribution licensees/SLDC to possess, furnish and use authenticated/realistic data/inputs for Resource Adequacy plan including for demand forecasting and if any unauthentic/unrealistic data/inputs are furnished/used by the distribution licensees/SLDC or any other responsible Utility, the Commission shall impose penalty as decided by the Commission to the distribution licensee/SLDC/concerned Utility and the same will not be passed on in the tariff.

20. Publication of the information on website

20.1 The monthly/weekly/day-ahead/intraday power procurements/sale by the distribution licensee and generator schedule shall be made available on the websites of the distribution licensees and SLDC within 15 days of such procurements/sale with ease of access to the current as well as archived data and the same shall be in a standardized format with downloadable facility for all.

20.2 SLDC shall also publish the monthly Merit Order Dispatch (MoD) stack along with per unit variable cost of each generating station on its website.

21. Constitution of dedicated Cells by Distribution Licensee

21.1 The Distribution Licensees shall establish a 'Planning Cell' for Resource Adequacy within one month of the Regulations coming into force. The Cell shall have the requisite capability and tools for demand forecast, capacity, RE integration, etc.

21.2 Another, round the clock dedicated 'Power Exchange Cell' shall also be constituted, if the same doesn't exist, by Distribution Licensees for power purchase/power sale in real-time, and also undertake intra-day, day-ahead, week ahead power procurement through Power Exchanges or any other means. Distribution Licensees shall frame suitable guidelines for the modus operandi of these dedicated Cells in line with the spirit of these Regulations and shall apprise the Commission for the same within one month from the date of coming into force of these Regulations.

21.3 The distribution licensee shall make the Resource Adequacy Plan in consultation with State Sector Generating Companies, other Distribution Licensees (in case of state wide uniform tariff), Central Sector Generating Companies, Transmission Companies, National / Regional / State Load Dispatch Centers, and Authority.

22. Resource Adequacy Implementation Timeline

22.1 The Resource Adequacy implementation timelines are as below and If there are any deviations from the timelines, the Commission can review and revise the timelines considering the reasons for such deviations keeping objective behind these Regulations.

(i) **30th April**: Distribution licensees shall submit demand forecasts to SLDC by 30th April of each year for the ensuring year(s) along with requisite information/details.

(ii) **31st May:** The SLDC, on behalf of the distribution licensees in the State shall provide to Authority, NLDC and SRLDC by 31st May every year, the details regarding demand forecasts (peak and energy requirement) for the next 10 years, assessment of existing generation resources and such other details as may be required for LT-NRAP and ST-NRAP.

(iii) **31st July:** Publishing of LT-NRAP and ST-NRAP respectively by Authority and NLDC by 31st July for the period starting from the month of April in the subsequent year.

(iv) **30th September:** The distribution licensees shall formulate their LT-DRAP and submit their resource adequacy plans to CEA by 30th September for the period starting from the month of April in the subsequent year for its vetting/validation.

(v) **30th November:** After being vetted by CEA, the LT-DRAP along with details for meeting the RAR of national peak for the Distribution licensee/utility and its own peak and energy requirement shall be submitted to the Commission by the Distribution licensee(s) by 30th November for the period starting from the month of April in the subsequent year for approval.

(vi) **31st December:** The Commission shall approve the Distribution licensee(s) contracting plan for coincident peak contribution and to meet their own energy and peak by 31st December of each year for the period starting from the month of April in the subsequent year.

(vii) **31st January:** The Distribution Licensee by 31st January shall submit the details of the contracted capacities for the ensuing year for meeting RAR of national peak to the SLDC after approval of the Commission.

(viii) **15th February:** The SLDC shall aggregate the total contracted capacities at the state level and submit the information to the SRLDC by 15th February.

(ix) **28th February:** SRLDC shall aggregate the capacities at the regional level and submit the information to the NLDC by 28th February.

(x) **March:** In case of shortfall, NLDC communication to the Commission on shortfall for compliance or NLDC will facilitate a national-level auction for the balance capacity with participation from distribution licensees with capacity shortfall. The contracting for the balance capacity shortfall shall be completed by the month of March prior to the start of the delivery year (1st April).

Chapter 8
Miscellaneous

23. Availability of mathematical modelling tools and study conducted for inspection

23.1 The mathematical modelling tools and study conducted by the distribution licensees/SLDC for Resource Adequacy Planning on directions by the Commission should be made available for inspection, testing and to run test cases by the Commission's office.

24. Power to Give Directions

24.1 The Commission may from time to time issue such directions and orders as considered appropriate for implementation of these Regulations.

25. Power to Relax

25.1 The Commission for reasons to be recorded in writing, may relax any of the provisions of these Regulations on its own motion or on an application made before it by an interested person.

26. Powers to Amend

26.1 The Commission may, at any time, vary, alter, modify or amend any provisions of these Regulations.

27. Power to Remove Difficulties

27.1 If any difficulty arises in giving effect to the provisions of these Regulations, the Commission may, by an order, make such provisions, not inconsistent to the provision of the Act and these Regulations, as may appear to be necessary for removing the difficulty.

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28. Repeal and saving

28.1 Save as otherwise provided in these Regulations, the KERC ((Load Forecast) Regulations, 2009 shall stand repealed from the date of commencement of these Regulations.

28.2 Notwithstanding such repeal, anything done or any action taken or purported to have been done or taken including any procedure, minutes, reports, confirmation or declaration of any instrument executed under the repealed regulations shall be deemed to have been done or taken under the relevant provisions of these Regulations.

By the approval of the Commission
(Secretary)
Karnataka Electricity Regulatory Commission

PD-126

ಮುದ್ರಕರು ಹಾಗೂ ಪ್ರಕಾಶಕರು:– ಸಂಕಲನಾಧಿಕಾರಿಗಳು, ಕರ್ನಾಟಕ ರಾಜ್ಯಪತ್ರ, ಸರ್ಕಾರಿ ಕೇಂದ್ರ ಮುದ್ರಣಾಲಯ, ಬೆಂಗಳೂರು

THAMMAIAH